

THE BEDBUG, *CIMEX LECTULARIUS*<sup>a</sup> LINNAEUS.

Pt. II<sup>b</sup>. Critical remarks on its literature, with a history and bibliography of pathogenic relations.

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A full bibliography of this insect, as promised in Part I of this paper, had to be abandoned because of its length. In contemplating its publication, the writer had in mind, mostly, its hoped for usefulness to both entomologists and medical men.

<sup>b</sup>Part I, Psyche XII, 1905 pp. 61-74.

Such a common, and persistently obnoxious insect must necessarily have a very extensive literature, and one that is much scattered, especially since it is a factor directly affecting the social communities of man himself.

In reviewing this body of literature, the writer has been continually impressed by one fact in particular, namely, that in the economic discussion of the bedbug by entomologists, the latter show almost an entire lack of knowledge of its medical literature; and so, conversely, the medical profession in discussing its hygienic, pathological or sanitary relation to man, quite often show great deficiency in their knowledge of its entomological literature. This has, therefore, led to many misleading, erroneous, and loose statements concerning the habits of the pest, made especially, however, in the medical literature and in the writings of zoologists and naturalists. These classes of writings have been found, in nearly all cases, to have been compiled from various unknown sources, both good and bad; the statement of course excepts the literature of experimental medicine. In the latter class of writings, the only fault to be found is the continual use of local or common names instead of the scientific one, such as, for instance, *bug* by the English, *wanze* by the Germans, *punaise* by the French, and so on. This use of vernacular names has thrown doubt on the value of the experiments performed, for the reason that they are entirely too general in their application.

Another point which has very forcibly struck the writer, is the great disproportion between the literature of this insect *en masse*, and the *real* facts now

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<sup>a</sup>By request, Dr. Ch. Wardell Stiles has carefully studied the synonymy of this insect, and has decided that *lectularius* is the type of *Cimex* Linnaeus. The insect will therefore retain its original name. *Acanthia*, *Klimophilos*, and *Clinoris* are rejected. Dr. Stiles' note will appear in Proc. Ent. Soc. Washington, VIII, 1906, probably in June of the present year.

known concerning its habits and life history.

The great majority of the accounts are simply re-compilations and appear to have no other purpose than to cover so much space in as rapid a manner as possible, as if the discussion of the bedbug was simply a matter of course, or of duty; to some it actually appeared to be distasteful, doubtless through false modesty. The addition of new facts was exceptional; unfounded statements, however, the rule. So that, taking the whole body of literature, we know more about the bedbug, *theoretically* than we do *actually*, a seeming paradox. The accounts by Southall (1730), De Bomare (1764), DeGeer (1773), Jördens (1801) and Curtis (1835) were good authorities even up to the last two decades, as late as 1890. Southall was probably the source of them all.

A state of affairs of this kind in the history of any insect, especially an important insect, should not be. It is true, that the majority of the accounts published on the bedbug were meant for the information of the general public, and were written in a popular way, but that fact does not excuse the carelessness with which they were compiled, especially since they were written by scientific men. In the remainder of the accounts, which were published as contributions to the knowledge of science, it would at least be expected to find something that really contributed, that were new facts.

In contrast to the great majority of writings on *lectularius*, however, the literature concerning its pathogenic relations is more careful in statement, and less obscure in meaning. This is to be expected from its nature, because experimental evidence is generally presented in the form of a clear statement of facts. But, notwithstanding this, nearly every paper which has been consulted, lacked one essential thing,—the scientific name of the insect in question. Until the species of insect with which experiments are being performed, is definitely known, uncertainty will always attend the results. This is especially true in the case of the bedbug and its near relatives, as just recently pointed out (Girault and Strauss, 1905). Unless the Latin name of the insect was given in the articles on the pathogenic relations, the conclusions drawn from the experiments recorded were always accompanied with doubt as to whether *lectularius*, *columbarius* Jenyns, or one of the other allied species were meant. Any one of the allied species would probably have behaved toward the small mammals used as hosts, as recorded in the experiments. Hence, the confusion.

As the writer has already given several practical illustrations of the poor character of some of the literature of this insect in part I of this paper

pp. 61, 72-74) and in a recent paper on host relations just mentioned (Girault and Strauss, 1905), and as he hopes to present elsewhere an abstracted bibliography of the whole, he considers it unnecessary to go into the subject deeper. Suffice it to say, that the few brief criticisms made on the literature of the bedbug, showing as it does needless repetition and speculation, should serve to warn us, in a measure, to be more careful in compiling accounts of our common economic insects, and furthermore, should urge us to make at least some effort to add new facts.

On account of the interest now being shown in the rôle of various insects in the transmission of diseases, and in order to attract the attention of entomologists to the bedbug's rôle in transmission, a brief history of its pathogenic relations follows.

In 1887, the famous Metschnikoff, in an article on certain phases of relapsing fever published in a well-known medical journal of Berlin, made general references to the bedbug as a carrier of diseases. This is believed to be the first time that the idea was definitely mentioned, and Metschnikoff may be held to be the originator of it.

A period of about five years then elapsed before anything more was said about the question, when in 1892 a Dr. Dewèvre published in Paris an account of a supposed case of the transmission of tuberculosis, which he discussed at length, and tried to establish. His evidence was quite insufficient, and the whole case did no more than to throw grave suspicions on the bedbug. This article was reprinted in the *Medical Record* of New York, and in the year following it was reviewed in *Insect Life*, a periodical published by the then Division of Entomology, U. S. Department of Agriculture, and in the *American Monthly Microscopical Journal* of Washington. Since then the case has been quoted and reviewed from time to time in medical journals and general treatises on medicine. It was founded on suspicious circumstances only.

In 1895, M. Morau, a Frenchman, published in the *Revue Scientifique* of Paris, an article on the contagiousness of cancer, in which he tried to establish, by means of experiments, that bedbugs carried the causative agent of that disease. The experiments were entirely negative.

Two years later, articles ascribing to the bedbug means of spreading diseases became more or less common. Dr. George H. F. Nuttall, formerly of Johns Hopkins University, Baltimore, then began his series of important experiments on the rôle of insects in the spread of diseases, which were continued over

several years and then, in the year 1900, summarized, together with a critical and historical study of the whole question. The possibility of the transmission of relapsing fever by bedbugs was considered by a Dr. Tictin, with negative experiments, while a Japanese writer, M. Yamagiwa, stated definitely that out of a large number of clinic cases of bubonic plague, one case was caused by the bite of a bedbug.

In the following year, 1898, Dr. Charles F. Craig, then Acting Assistant Surgeon, U. S. Army, quoted the cases of Tictin and Morau, and called attention to the lack of knowledge of the question involved. Experiments on the transmission of anthrax by bedbugs were recorded by M. Joly, with negative results while one of his fellow-country men, Dr. Simond of the Pasteur Institute, stated in a lengthy article on bubonic plague, that the flea and the bedbug were the two "parasites", *a priori*, which were able to assume a role in the transmission of that dangerous disease. He thought it probable that the bedbug intervened in the transmission of that disease from man to man.

During 1899, MM. Calmette and Salembeni, in the annals of the Pasteur Institute, wrote of a case of bubonic plague in which the bedbug's bite formed a starting point of the disease. During the same year, Dr. Carmichael, of the U. S. Marine-Hospital Service, said,—“It is suspected that certain insects play a part in the transmission of leprosy, the common housefly, mosquito, and bedbug being the principal carriers of infection.” In 1899, Dr. Coplin, of the Jefferson Medical College, Pennsylvania, proved that pure cultures could be inoculated from infected bugs: the infections were those of typhoid fever. After discussing the parts played by household insects in spreading certain diseases, he concludes by saying, “The danger from the bedbug and roach would probably be great in diphtheria and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases.” But conclusions opposite to this were reached by Muhling in a paper published at Jena about the same time. He concluded that of themselves, bedbugs could not carry contagions, but that their bites would naturally form a *porte d'entrées* for pathogenic bacteria.

With the exception of minor articles, the only other important writing which has been published on bedbugs and their relations to human diseases is that of Dr. Nuttall, mentioned in foregoing. This was first published at Berlin, in 1899, and reprinted the following year in the *Johns Hopkins Hospital Reports*. (Nuttall, 1900.) It critically discussed all the experimental evidence then

recorded concerning the transmission by bedbugs of anthrax, bubonic plague mouse-septicemia, chicken-choleia, *Bacillus septicus*, relapsing fever, and tuberculosis. Nuttall concluded that nothing had been positively proven, and his conclusion holds up to the present time.

*BIBLIOGRAPHY OF THE PATHOGENIC RELATIONS OF  
THE BEDBUG.*

1887. Metschnikoff, Elias. Ueber dem phagocytenkampf beim rückfalltyphu s Archiv f. pathologische anatomie und physiologie, und f. klinische medicine, herausgegeben von Rudolf Virchow (Virchow's Archiv) Berlin, Bd. 109, .pp. 176-192.  
General references to transmission of diseases by the bedbug.
- 1892 a. Dewèvre, (Docteur). Note sur le role des pediculi dans a propagation de l'impétigo. Comptes rendus hebdomadaires des lséances et mémoires de la Soc. de biologie. Paris, tome quatrième, nevième séries: pp. 232-234.  
From Nuttall (1899), p. 32. The reference is evidently a wrong one ; tuberculosis and the bedbug are not mentioned.
- 1892 b. Dewèvre, (Docteur). Note sur la transmissibilité de la tuberculose par la punaise des lits. Revue de médecine, Paris, XII, pp. 291-294.  
Account of a case of supposed transmisison, with discussion. "La punaise des lits peut donc jouer quelquefois un rôle assez important dans la propagation de la tuberculose,et nous estimons qu' à l'avenir l'hygiène devra tenir compte de ce facteur nouveau en édictant les règles minutieuses de la désinfection." P. 294.
1892. Editors. Bedbugs—. Medical Record, New York XLII, p. 347. Brief summary of Dewèvre (1892 b). Cf. Riley and Howard (1893).
1893. Riley, Charles Valentine and Leland Ossian Howard. An insect transmitter of contagion. Insect Life, U. S. Dep. Agric., Division Ent., Washington, V, p. 210.  
Quote Editors (1892).
1894. Alleger, W. W. On the limitation of tuberculosis. Bedbugs as sources of infection. American monthly microscopical journal, Washington,

XV, pp. 295-296.

Briefly gives statements of Dewèvre (1892).

1895. Morau, Henry. Le cancer est contagieux. *Revue scientifique*, Paris, LV, (III, séries 4), pp. 42-43.  
Brief account of experiments with bedbugs.
1896. Galli-Valerio, Bruno. Manuele di parassitologia in tavole sinottiche (vermi e artropodi dell'uomo e degli animali domestici), Milano, pp. 124-125, tavola LXIII.  
Listed as *Acanthia lectularia*, with a note to the effect that it is supposed to transmit tuberculosis.
1897. Editors, (J. H.) Les punaises et les moustiques comme agents de contagion. *Revue scientifique*, Paris, LIX, (VII, series 1), pp. 110, 112-113.  
Review of experiments on the relation of bedbugs to infections in general. Vide Tictin, 1897.
1897. Marpmann, G. Ueber den zusammenhang von pathogenen bakterien mit fliegen. *Centralblatt f. bakteriologie, parasitenkunde und infektionskrankheiten*, Jena, Bd. XXII, erste abteilung, pp. 127-132.  
Includes theories concerning the relation of bedbugs to pathogenic bacteria of animals and man. Vide Nuttall (1899) p. 23.
1897. Nuttall, George H. F. Zur aufklärung der rolle, welche die insekten bei der verbreitung der pest spielen.—Ueber die empfindlichkeit verstchiedener tiere fur dieselbe. Eine experimentelle studie. *Centralblats f. bakteriologie, parasitenkunde und infektionskrankheiten*, Jena, Bd XXII, erste abteilung, pp. 91-93, (Versuche mit Wanzen).  
Inoculation experiments with *wanzen*, using as hosts small mammals. For general review, vide Nuttall (1900).
1897. Tictin, J. Zur lehre von ruckfalltyphus. *Centralblatt f. bakteriologie parasitenkunde und infektionskrankheiten*, Jena, Bd. XXI, erste abteilung, pp. 181, 182-186.  
"Ueber die Möglichkeit der Uebertragung Ruckfalltyphus durch Wanzen". Relation of bedbugs to "*Febris Recurrens*", with negative experiments.

1897. Yamagiwa, K. Ueber die Bubonenpest. Archiv f. pathologisches anatomie und physiologie, und f. klinisches medicin. Herausgegeben von Rudolf Virchow (Virchow's Archiv), Berlin, Bd. 149, supplementheft, p. 109.  
 "Ausserdem habe ich bei einem Patienten (Fall L11) in dem Granulationsgewebe des vor der Erkrankung durch dem stich einer Bettwanze entstandenen Gescwurs am linken Unterschenkel, auf \* \* \* \* \*."
1898. Craig, Charles F. The transmission of disease by certain insects: ticks, bedbugs, ants, etc. Bedbugs and the transmission of disease. New York Medical Journal, New York, LXVIII, pp. 598-599, figs. 3-4. Quotes Westwood (1840) and Uhler (1884), and gives the substance of the experiments of Titkin (Tictin, 1897) and Morau (1895); figures from Osborn (1896). Lack of knowledge of the question involved.
1898. Joly, Raoul Adrian Paul. Importance du rôle des insectes dans la transmission des maladies infectieuses et parasitaires. Du formal comme insecticide. Bordeaux, thèse, 90 pp.  
 Includes experiments with bedbugs and anthrax; rabbits used as host. Experiments negative.
1898. Nuttall, George H. F. Zur aufklärung der rolle, welche stechende insekten bei der verbreitung von infektionskrankheiten spielen. Infektionsversuche an mäusen mittels mit milzbrand, hühnercholera und mäusesepitikiämie infezierter wanzen und flohe. Centralblatt f. bacteriologie, parasitenkinde und infektionskrankheiten, Jena, Bd. XXIII, erste abteilung, pp. 625-635.  
 Important inoculation experiments with *wanzen*. Cf. Nuttall (1900).
1898. Simond, P. L. La propagation de la peste. Annales de l'institut pasteur, Paris, XII, pp. (625-687), 672-673, 677, 687.  
 "La puce et la punaise sont les deux parasites qu'on peut, *a priori*, soupçonner de jouer un rôle dans la transmission du bacille de la peste." pp. 672-673.  
 "\* \* \* par certaines particularités de la transmission du rat à l'homme et d'homme à homme; pour ce dernier cas, il est possible que d'autres parasites, enparticulier punaise, interviennent; \* \* \* \* \*". P. 687.
1899. Abbott, Samuel W. Public hygiene and preventive medicine. The

- management and control of infectious diseases. Insects as transmitters of infection. The American year-book of medicine and surgery, Philadelphia, (Gould), pp. 996-997.
- A digest of the experiments of Nuttall (1897, 1898). Bedbugs transmit but rarely.
1899. Calmette, A. and A. T. Salimbeni. La peste bubonique. Etude de l'épidémie d'Oporto en 1899. Sérothérapie. Annales de l'institut pasteur, Paris, XIII, p. 883.  
 " \* \* \* \* \*, le point de départ de la lésion avait été une piqure de punaise." Observations.
1899. Carmichael, D. A. Leprosy in the Hawaiian Islands. The Medical News, New York, LXXIV, p. 95.  
 Abstract from Public Health Reports, to Supervising Surgeon-General, U. S. Marine-Hospital Service, Dec. 30, 1898.  
 "It is suspected that certain insects play a part in the transmission of leprosy, the common house fly, mosquito, and bedbug being the principal carriers of the infection."
1899. Coplin, William M. Late. The propagation of diseases by means of insects, with special consideration of the common domestic types. Philadelphia med. journal, Philadelphia III, pp. 1303-1307, 6 text-figs.  
 Address delivered before the Pennsylvania State Medical Society, Johnstown, Pennsylvania, May 17, 1899.  
 General account of the part played by household insects in transmitting diseases, with an account of experiments performed with bedbugs, roaches, and flies as carriers of bacteria, especially the bacilli of typhoid fever. Figures petri cultures made by contact with infected bugs.  
 "The danger from the bedbug and roach would probably be great in diphtheria, and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases." p. 1306.
1899. Mühlhng, Paul. Die uebertragung von krankheitserregern durch wanze und blutegel. Centralblatt f. bakteriologie, parasitenkunde und infectionskrankheiten, Jena, Bd. XXV, erste abteilung, pp. 703-706.  
 Original experiments with bedbugs. "Aus allen diesen Thatsachen ergibt sich also sicher; dass der Wanzenstich an sich nichts zu bedeuten



hat, abgesehen natürlich von der dadurch gesetzten Hautlasion, welche später eine porte d'entrée für Bakterien sein kann, dass er aber durch Zerquetschen und Zerreiben des Blutsaugers an der gestochenen Stelle gefährlich werden kann insofern, als Mikroorganismen in den Stichkanal eindringen, welche oberflächlich der Wanze anhaften oder in Därme derselben enthalten sind." p. 705.

1899. Nuttall, George H. F. Die rolle der insekten, arachniden (Ixodes) und myriapoden als trager bei der verbreitung von durch bakterien und thierische parasiten verursachten krankheiten des menschen und der thiere. Eine kritisch-historische studie. Hygienische Rundschau, Berlin, IX, pp. 218-220, 277-278, 279, 280, 281, 283, 394 395, 400.  
Historical and experimental evidence of the transmission of diseases by the bedbug; its relation to anthrax, plague, mouse septicæmia, chicken-cholera, *Bacillus septicus*, relapsing fever, and tuberculosis. Criticism and review of all experiments to date. Vide Nuttall (1900).
1899. Popoff, Leo. Relapsing fever. Twentieth century practice. An international encyclopedia of modern medical science by leading authorities of Europe and America, New York, XVI, infectious diseases, p. 476.  
Gives the results of Titkin (Tictin 1897).
1900. Nuttall, George H. F. On the rôle of insects, arachnids and myriapods as carriers in the spread of bacterial and parasitic diseases of man and animals. A critical and historical study. Johns Hopkins Hospital Reports, Baltimore, VIII, pp. 13-14, 17, 18, 20, 22 23, 24-25, 32-33, 39, 120.  
About the same as Nuttall (1899).
1900. Packard, Frederick A. Transmission of infectious agents by insects. Progressive medicine, Philadelphia and New York, I, pp. 136 138.  
Review and digest of Nuttall (1900) and Coplin (1899).
1900. Riesman, David. The rôle of insects, arachnids, and myriapods as agents in the spread of diseases due to bacteria or to animal parasites in men and animals. American year-book of medicine and surgery, (Gould), Philadelphia, Medicine, p. 324.  
Digest of Nuttall (1899) and Coplin (1899); no proof of the conveyance of tuberculosis has been furnished.

1901. Dawson, Charles F. The dissemination of infectious diseases by insects. American veterinary review, New York, XXV, p. 267.  
Quotes the case of Dewèvre (1892).
1901. Homan, George. On the agency of parasitic vermin and other insect pests in the spread of disease. American medicine, Philadelphia, II, pp. 536-537.  
Read before the Division of Maritime Hygiene and Quarantine, Third Pan-American Medical Congress, Havana, February, 1901. General article: contains the following very interesting sentences:—"One of the most cosmopolitan and formidable of human parasites remains to be mentioned—*Cimex lectularius*—and one whose potency for harm in a public health sense has hardly been adequately measured perhaps by reason of its \* \* \* nocturnal habits \* \* \* \* \*"  
"The *Cimex*, but its activity in temperate climates coincides very nearly with the usual maximum prevalence of yellow fever and malarial diseases \* \* \* \* \*". Its stubborn inhabitation of human dwellings, however, points significantly to it as at least a coadjutor in the persistence of the first-named disease, where it is endemic, and as an influential agent in the spread of other infections as certain forms of tuberculosis, syphilis, leprosy, carcinoma, and peradventure bubonic plague." p. 537.
1902. Flugge, Carl. Grundriss der hygiene für studierende und praktische artze, medicinal—und verwaltungsbeamte. Leipzig, funfte, vermehrte und verbesserte auflage, pp. 473, 532, *et al.* Edit. 1, 1891.  
Believes that vermin in general spread *Febriß recurrens*.
- 1902 a. Howard, Leland Ossian. How insects affect health in rural districts. Farmer's Bull, No. 155, U. S. Dep. Agric. Washington, p. 18, fig. 15. Yearbook U. S. Dep. Agric., Washington, 1901, p. 190, fig. 19.  
Contains the following sentence, in referring to the transmission of diseases by insects, "Even the common bedbug is strongly suspected in this connection." Figures adult.
- 1902 c. Howard, Leland Ossian. Mosquitoes. How they live; how they carry disease; how they are classified; how they may be destroyed. New York, p. 65.  
Grassi (1900) excludes the bedbug and others from being possible car-

riers of malaria, on the strength of their wide distribution. Grassi has not been seen, and is not listed.

1903. Jennings, William Ernest. A manual of plague, London, p. 32.  
Bugs may be carriers of plague.
1904. Bergey, D. H. The principles of hygiene. A practical manual for students, physicians, and health-officers. Philadelphia, New York and London, edit. 2, revised, pp. 378, 390, 391, 394, 400, 412.  
The bedbug is believed to be instrumental in disseminating the parasite of relapsing fever; and other diseases.
1904. Herzog, Maximilian. The plague: bacteriology, morbid anatomy, and histopathology, including a consideration of insects as plague carriers, Bull. No. 23, (U. S.) Dep. Interior, Bureau Govt. Laboratories, Boil Laboratory, Manila, pp. 75, 83.  
States Nuttall's (1897) results; bacteriological examination of five bedbugs taken from a room in which a plague patient slept.
1904. Titus, Edward Sharpe Gaige and Frederick Charles Pratt. Catalogue of the exhibit of economic entomology at the Louisiana purchase exposition, St. Louis, Mo., 1904. Bull. No. 47, U. S. Dep. Agric., Bureau Ent., Washington, p. 120.  
Listed under the heading, *Insects which may spread disease.*
1905. Bolduan, Charles and Mary E. Goodwin. A clinical and bacteriological study of the communicability of cerebro-spinal meningitis and the probable source of contagion. Medical news, New York, LXXXVII, p. 1226.  
"The vermin theory of infection also presupposes the presence of the meningococcus in the peripheral blood of the patients. \* \* \* \* \*  
Even when present it does not appear to be so abundant that fleas or bedbugs would be likely to ingest one very often."
1905. Girault, Alexandre Arsène and John Frank Strauss. The bedbug, *Clinocoris lectularius* (Linnaeus), and the fowl-bug, *Clinocoris columbarius* (Jenyns) host relations. Psyche, Cambridge, Mass., XII, pp. 117-120.  
Adults and larvae attacked in confinement recently dead, and living, mice. Brief discussion of host relations. Cf. Laidy, 1877, Proc. Acad.

Nat. Sciences, Philadelphia, XXIX, p. 284.

1905. Harrington, Charles. The relation of insects to human diseases. Bedbugs. A manual of practical hygiene for students, physicians, and medical officers. Edit. 3, revised, Philadelphia and New York, pp. 640-641. Dewèvre's (1892) case cited. Nuttall's (1899) experiments negative. Muhling (1899) agrees that no danger of infection is to be apprehended from the bites alone.
1905. Radcliffe-Crocker, Henry. Animal parasites of the skin. Diseases of the skin, their description, pathology, diagnosis, and treatment, with special reference to the skin eruptions of children. Edit. 3, revised, Philadelphia, II, pp. 1357, 1386.  
By H. Radcliffe Crocker, Edit. 1, 1888, London and Philadelphia, pp. 708-709. Edit. 2, 1893, London, p. 877. Edit. 2, 1893, Philadelphia, p. 925.  
Brief description of the bite with treatment.
1905. Simpson, W. J. A treatise on plague, dealing with the historical, epidemiological, clinical, therapeutic, and preventive aspects of the disease. Cambridge, p. 222.  
Gives the case of Calmette and Salimbeni (1899).
1905. Walsh, James J. (Anon). Disease and dirt and the tramp. The Independent, New York, LVIII, pp. 680-681.  
Lengthy editorial on probable transmission of cerebro-spinal meningitis by insect blood parasites. Reference to the transmission of relapsing fever by the bedbug.

For reference to a few, apparently, unimportant papers not listed or seen, consult Tictin, 1897.

*LITERATURE REFERRED TO IN PARTS I & II*

1730. Southall, John. A treatise of buggs: showing when and how they were first brought into England. How they are brought into and infect houses. Their nature, several foods, times and manner of spawning and propogating in this climate. Their great increase accounted for, by proof of the numbers each pair produce in a season. Etc., Etc., London, v-xii + 44 pp.; frontispiece of 16 figures. Hamburg, 1737; Berlin 1742; new edit. 1793.

A very full account of *lectularius*, monographic in nature, which strangely has been followed by many to date. A copper-plate is given of 16 duplicate figures of the eggs, larvae at weekly periods of growth, European and American specimens, all said to be of natural size, and of an enlarged adult; figures nearly recognizable. Recommends winter treatment, simple furniture, and avoidance of soft woods, second-hand furniture, and washerwomen. The account of course is full of errors, due to the times. Southall states that he could find no works on *lectularius* previous to his. No references are given.

1764. De Bomare, Valmont. La punaise de lit, *Cimex domesticus*. Dictionnaire raisonné universel d'histoire naturelle; contenant l'histoire des animaux, des végétaux et des minéraux, et celle *etc., etc.* Paris, tome quatrième, pp. 519-522. An old, but important, account.
1773. De Geer, Carl. Punaise des lits. Mémoires pour servir à l'histoire des insectes, Stockholm, III, pp. 296-305, pl. 17, figs. 9-15.  
Good account. Synonymy; origin, description, habits, feeding-habit and effect of bite; remedial measures with experiments; predaceous enemies; recommendations; length of life without food. Cf. Jordens (1801) p. 33. Latreille (1807) and Westwood (1840), gives wrong reference.
1801. Jordens, Johann Heinrich. Die Bettwanze. Entomologie und helminthologie des menschlichen korpers, oder beschreibung und abbildung der bewohner und feinde desselben unter den insekten und wurmern. Hof, erster band, pp. v, 32-40, tab. I, figs. 16-25.  
Description of the egg, young and adult; external sexual characters; distribution and occurrence; effect of bite; De Geer's observations on the effect of the attack on two persons; enemies; remedies; figures with details. A very important account, with apparently complete bibliography to date.
1807. Latreille, Pierre André. Genera crustaceorum et insectorum secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata. Parisiis et Argentorati, tomus tertius, p. 137. Paris, 1807, pp. 36-37.  
Defines *Cimex* and fixes *lectularius* as type.

1833. Dufour, Leon. Recherches anatomiques et physiologiques sur les Hemiptères, accompagnées de considérations relatives à l'histoire naturelle et à la classification de ses insectes. Mémoires des Savants étrangers à l'Acad. de Science, Paris, IV, pp. 184 ff. Separate, Paris 1833.  
From various authors. Vide Landois (1869) p. 230. Not seen. Much quoted.
1835. Curtis, John. *Cimex lectularius*. The House—or Bed-bug. British Entomology, London, XII, p. 569, pl. 569, 9 figs.  
Description and history of distribution; remedial measures. Good, colored figure of adult, with details.
1839. Jenyns, Leonard. On three undescribed species of the genus *Cimex* closely allied to the common bed-bug. Annals and Mag. Natural Hist., London, III, pp. 241-244, pl. V, figs. 1-3.  
(? Isis, 1844, XI, p. 830.)  
Original descriptions of *Cimex columbarius*, *hirundinis*, and *pipistrelli*, with characteristics of each and a synoptic table of the species including *lectularius*. Hagen (1862, *Bibliotheca Entomologica*, Leipzig) gives wrong reference.
1840. Westwood, John Obadiah. An introduction to the modern classification of insects: founded on the natural habits and corresponding *etc.* London, II, pp. 465, 474-477, fig. 121, 1 and 4. Synopsis, p. 120.  
Restricts *Cimex* to one species, *lectularius*. Good account, mostly historical. Figures poorly the adult and larva.
1855. Fitch, Asa. The Chinch Bug. Rep. on the noxious, beneficial, and other insects of the State of New York, in Trans. New York State Agric. Soc., XV, p. 523. Separate, 1856, Albany, p. 291.  
Mentions the change in application of the word *chinche* from *lectularius* to *Blissus leucopterus* Say.
1868. Landois, Leonard. Anatomie der Bettwanze (*Cimex lectularius* L.) mit Berichtigung verwandter Hemipterengeschlechter. Zeitschr. f. wissenschaftliche zoologie (Siebold und Kolliker), Leipzig, Band XVIII, pp. 206-224, tafeln XI-XII, figs. 1-14.  
Brief history; names; anatomy of the digestive organs; of the salivary glands; and of the odoriferous glands, with good figures. Continued in Landois (1869).

1869. Landois, Leonard. Anatomie der Bettwanze (*Cimex lectularius* L.) mi-berücksichtigung verwandter Hemipterengeschlechter. Zeitschr. f. wissenschaftliche zoologie (Siebold und Kölliker), Leipzig, Band XIX, pp. 206-233, tafeln XVIII-XIX, figs. 1-25.  
A continuation and conclusion of Landois (1868). Anatomy of the organs of respiration; of the fat bodies; of the male and female reproductive organs, including a description of the ripe egg; of the nervous system; of the body segments, wing covers and legs; and of the muscles. Also a list of 25 titles, and four references to figures.
1884. Uhler, Philip Reese. Standard Nat. History, Boston, II, p. 285, fig. 328. Riverside Nat. History, Boston and New York, II, p. 285, fig. 328. Brief account, with figure. Osborn (1896) gives wrong reference, which is copied by Craig (1898).
1885. Lintner, Joseph Albert. The bed-bug infesting a library. Second Rep. on the injurious and other insects of the state of New York, Albany, pp. 16-18, 152.  
Quotes correspondent; house found infested, the insects hiding in numbers in books and files of papers. Brief history and habits, with remedies. On p. 152, a note in regard to other applications of its common names (Vide Fitch, 1855.)
- 1886a. D'Herculeis, Jules Kunckel. La punaise de lit et ses appareils odoriferants.—Des glandes abdominales dorsale de la larve et de la nymphe; des glandes thoraciques sternales de l'adulte. Comptes rendus de l'Academie des Sciences, Paris, CIII, pp. 81-84. Separate, Paris, 5 July, 1886, 4 pp.  
Preliminary description of the oderiferous glands of the larva and adult. Cf. D'Herculeis (1886b).
- 1886b. Idem. La punaise de lit et ses appareils odoriférants -Changement de situation et de forme de ces appareils aux differents ages de l'insecte. Comptes rendus hebdomadaires des seances et memoires de la Société de biologie, Paris, tome troisieme, huitieme serie, pp. 375-377.  
"En resume, la punaise de lit possede depuis son eclosion, a l'etat de larva et de nymphe, trois glandes, odoriferiques abdominales dorsales qui disparaissent lors de la derniere mue et sont remplacées, a l'etat adulte, par un appareil glandulaire metathoracique sternal. La presence de cet appareil

est un critérium qui permet de démontrer que ce Cimex est arrivé au terme son évolution." p. 377.

- 1886c. Idem. Recherches sur les glandes odorifiques des insectes hémiptères, et particulièrement sur celles de la punaise de lit. Mécanisme de la secretion. Valeur dans la classification; Association française pour l'avancement des sciences, Congrès de Nancy, XV, pp. 528-532, 2 figs. Separate, Paris, 1886, 5 pp. 2 figs.  
Description and anatomy of the odoriferous glands of larva and adult, with illustrations.
1887. Riley, Charles Valentine. Poisonous insects. Reference Handbk. of the Medical Sciences, New York, Edit. I, V, p. 752. Separate, New York, 1887, p. 752.  
Brief account, Cf. Osborn (1902).
1893. Butler, Edward Albert. The Bed-bug. Our household insects, London, pp. 273-303, pl. VI, text-figs. 85-101. Knowledge, London, 1890, XIII, V, new series, pp. 209, 225, 251, 275, and cf. Butler (1894). Reviewed, Westminster Budget, Oct. 6, 1893, Westminster Gazette, Oct. 10, 1893.  
Good account, including etymology and origin of common and scientific names, anatomy, general description of the stages, remedies, enemies, ancient uses and insects mistaken for; with good figures of adult female and anatomical details.
- 1896a. Luggler, Otto. The Bed-bug (*Acanthia lectularia* Linn.) Bull. No. 48, Minnesota Agric. Exp. Station, St. Anthony Park, pp. 222-227, figs. 159-165.  
Good popular account; allied species.
- 1896b. Idem. Second annual Rep. Ent. of the state experiment station of the University of Minnesota, to the governor, for the year 1896. Delano, pp. 196-201, figs. 159-165.  
Same as Luggler (1896a).
- 1896a. Marlatt, Charles Lester. The Bedbug. (*Cimex lectularius* Linn.) Bull. No. 4, new series, U. S. Dep. Agric. Division Ent., Washington, pp. 32-38, figs. 7-9. Revised Edit., 1902.  
Very good general account of what is known to date of habits and life history. Number of molts first stated. Excellent figures.



1896. Osborn, Herbert. The common bed-bug. (*Acanthia lectularia* Linn.) Bull. No. 5, new series, U. S. Dep. Agric., Division Ent., Washington, pp. 12, 157-160, 162, 163, figs. 88 89, 92b. Cf. pp. 286-287. Good history and account, with remedies. Figures nymph, adult, and antennae; compares with descriptions, the more common allied species, quoting Jenyns' (1839) descriptions. Host relation.
1901. Howard, Leland Ossian. Life-history of the bedbug. The Insect Book, New York, pp. 289-290, figs. 178, 179. Good popular account, with figures of young larva and adult.
1902. Osborn, Herbert. Insects, parasitic. A reference hand-book of the medical sciences, embracing the entire range of scientific and practical medicine, and allied sciences, by various authors. New York, new, revised edit., V, MDCCCII, pp. 155-156, figs. 2865-2867. General account; figures copied. cf. Riley (1887).

*ERRATA et CORRIGENDA, PART I.*

- Page 61, 2nd line of title, *lectularia* read *lectularius*.  
 Ibidem, insert parentheses about *Linnaeus*.  
 71, 3rd. footnote, *Titkin* read *Tickin*  
     2nd. paragraph, insert quotation marks about *bacilli*.  
     3rd. paragraph, *contagious* read *infectious*.  
 72, 3rd. paragraph, *Cimex* read *Clinocoris*.

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